THE WALL STREET JOURNAL.

MONDAY, DECEMBER 16, 2002 - VOL. CCXL NO. 118

Perchlorate in America

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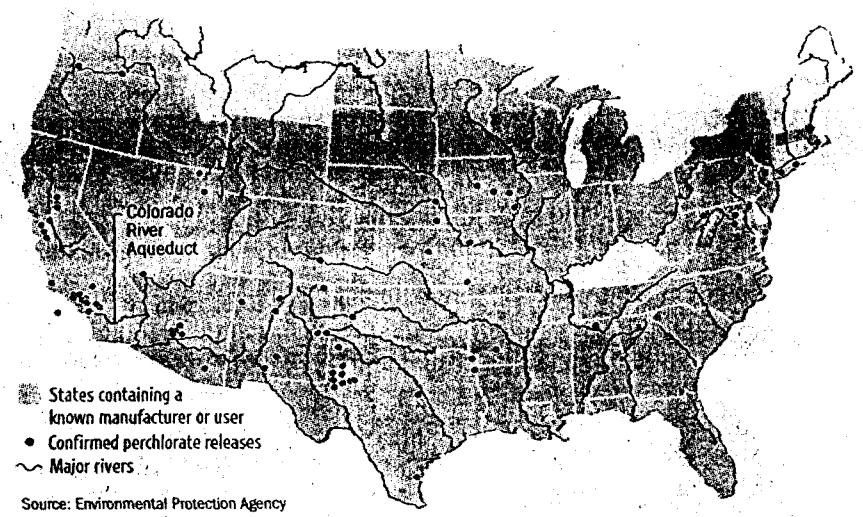

Source: Environmental Protection Agency

Seeping Threat

A Fuel of Cold War Defenses Now Ignites Health Controversy

Perchlorate Runoff Makes Way To Water Supply of Millions; Pentagon Clashes With EPA

Greg Voetsch's Two Tumors

By Peter Waldman

RANCHO CORDOVA, Calif.—For years, Greg and Doris Voetsch felt they were living a suburban dream here on the banks of the American River.

Just 15 miles from downtown Sacramento, they raised four kids on homegrown cherries, pears, cucumbers and string beans, along with salmon and rainbow trout caught in the Sierra-fed waters flowing just beyond their back door. Mr. Voetsch, a landscaper, used tobacco juice, instead of pesticides, to keep the aphids at bay. Snow-melt was their air-conditioning, cooling the hot summer breezes. The cost of living was "almost nothing," Mr. Voetsch says.

But trouble seeped into their paradise. In 1983, 13 years after the family moved here, surgeons removed two tumors, each of a different type of cancer, from Mr. Voetsch's thyroid gland. Shortly after, his two older daughters, both in their 20s at the time, had surgery to treat thyroid-related problems. Last year, his 67-year-old wife, who has had thyroid trouble for years, had a benign brain tumor removed. The couple's daughter-in-law, who grew up nearby, also has thyroid problems. Her son—the Voetsches' grandson—is autistic.

Greg Voetsch

Five years ago, the Voetsches learned that the home they bought in 1970 lies on the edge of a so-called plume of underground water polluted with waste from a nearby missile factory. Among the chemicals found in local drinking wells is perchlorate, the main ingredient of solid rocket fuel and a known toxin. The Voetsches believe it was in their water and, they suspect, their garden soil. "We lived off the land and never thought twice about it," Mr. Voetsch says.

In the human body, perchlorate affects production of thyroid hormones—a phenomenon that the Environmental Protection Agency says can cause thyroid ailments such as Graves' disease and cancer in adults. Fetuses and newborns, the EPA says, are at even greater risk, susceptible to neurological and other developmental damage.

For decades, millions of Americans have been unknowingly exposed to perchlorate through their local water supplies. No one denies that the chemical is toxic. But the level at which it becomes dangerous in drinking water is the subject of a fierce debate that pits the EPA against the Pentagon and its defense-industry allies. As a result, the U.S. is still years away from establishing a nationally enforced standard, and until it does so, a poisonous chemical lingers in the environment in amounts that could still be causing the slow spread of serious disease on a large scale.

To date, the EPA has identified 75 perchlorate releases in 22 states, including Arizona, Texas, Nebraska, Iowa, New York, Maryland and Massachusetts, as well as California. The Colorado River, the main water source for about 15 million homes across the Southwest, contains perchlorate at roughly seven parts per billion—seven times the level that the EPA's National Center for Environmental Assessment says is safe.

Defense-industry dumping is suspected in nearly all these cases, though perchlorate has also been linked to fireworks and other explosives, automobile airbags and Chilean fertilizers, some of which may have been used near the Voetsches' home. The EPA says it will take hundreds of years and cost several billion dollars to clean up the known plumes.

The EPA wants suspected water supplies tested nationwide for perchlorate, but the Pentagon, which argues perchlor-

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Perchlorate Reaches Water Supply of Millions

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ate isn't dangerous in small doses, is resisting in many cases. Instead, the Pentagon has asked Congress for an exemption from environmental laws covering the cleanup of explosive residues at operational sites.

It's impossible to determine definitively whether perchlorate caused the Voetsches' ailments and similar maladies reported by hundreds of other people in affected areas. California's Department of Health Services is studying local health statistics for correlations between perchlorate levels in local drinking water and rates of thyroid and other disorders associated with the chemical. Eight states have passed advisory limits on perchlorate, ranging from one part per billion in Maryland, Massachusetts and New Mexico, to two ppb in California and 18 ppb in Nevada.

The EPA worries even the smallest traces of perchlorate are dangerous, particularly to infants at risk of neurological damage because thyroid-hormone production is crucial to normal brain development. In January, the agency's national assessment center proposed a draft "reference dose" for perchlorate in drinking water of one part per billion. That recommendation, when finalized after a peer review process, goes to the EPA's Office of Water, which ultimately proposes a national standard after weighing costs and benefits.

"After everything I've seen on perchlorate, I'm a lot more concerned about even subtle deficiencies of thyroid hormone on brain development than I was before," says biologist Thomas Zoeller, an endocrine expert at the University of Massachusetts at Amherst and one of the 17 peer reviewers of the EPA's draft reference-dose report.

Billions in Cleanup Costs

The Pentagon and several of its major contractors, all facing billions of dollars in possible cleanup and liability costs, say perchlorate is perfectly safe in trace amounts. They argue the chemical, an ordinary salt ion similar to nitrate, should be allowed in drinking water in concentrations up to 200 ppb. "The scientific basis for believing there's harm has not been established," says Maureen Koetz, assistant undersecretary of defense for the environment.

That perchlorate is an issue at all is a legacy of the Cold War, when the priorities of containing communism trumped domestic considerations for the environment and public safety. The military started using perchlorate in solid rocket fuel and other propellants in the 1940s. At the time, the chemical wasn't considered very toxic. Millions of tons of it were simply flushed onto the ground, left to flow unimpeded into streams and underground aquifers.

The polluting continued for years after evidence began to mount of the dangers of perchlorate. A three-month investigation by The Wall Street Journal has found that even after California regulators tried to control disposal of the chemical in the 1950s, companies dumped it with impunity. It wasn't until the 1970s, after passage of federal clean-water laws, that the defense industry began trying to contain perchlorate waste for treatment. But by then, the chemical had already begun its long, slow seep into water supplies nationwide.

As late as 1976, in fact, Aerojet-General Corp., operator of the missile plant near the Voetsches' home, built a special, 3,500-foot pipeline to dump toxic waste into unlined earthen pits—directly disobeying a local water-board order issued just months earlier, state documents show. At first, Aerojet told investigators the pipe was just a stopgap measure to bypass a clogged holding pond.

"A 3,500-foot pipeline may not quite be temporary," acknowledges William Phillips, longtime general counsel of Aerojet's parent, GenCorp of Sacramento. But Mr. Phillips and other defense-industry officials say that the contractors' disposal practices were state-of-the-art at the time, particularly for a chemical they didn't—and still don't—consider very harmful. Moreover, the defense suppliers say they followed all orders and guidelines issued by the Pentagon, which owned and managed most of the perchlorate supply and put its own inspectors inside factories to ensure proper handling.

The Pentagon, for its part, says its job is national security, not environmental safety. "We are no different from any other set of individuals who operate in states and localities and follow the laws," says Ms. Koetz, the assistant undersecretary of defense. "We do not consider it our job to get out in front of the health and environmental regulatory agencies in terms of discovering" pollution risks.

"Should someone have connected the dots in 1962, 1972 or 1982? Absolutely," says Kevin Mayer, an EPA Superfund official in San Francisco and the agency's point man on perchlorate. "But it didn't happen. There isn't any one person or one agency that definitively dropped the ball. Everyone did nothing."

That's what upsets people living in perchlorate-polluted areas. Though tests revealed high levels of perchlorate in the Voetsches' neighborhood water as far back as 1963—seven years before they moved in—state water regulators declared local wells safe. The Voetsches joined a class-action lawsuit in 1998, filed in Sacramento state court, accusing Aerojet, Boeing Co. and two local water utilities of negligence and fraud. The defendants contest the allegations, and the case is pending.

"I think they knew it was dangerous and just kept doing it," says Mr. Voetsch, now 68 years old. "There was nobody there to stop them, and nobody was the wiser."

Perchlorate fueled the takeoff of American rocketry. During World War II, the Navy tapped Theodore von Karman, a Hungarian-born aeronautics professor at California Institute of Technology, to develop engines powerful enough to lift planes off the short flight decks of aircraft carriers. He and some other rocket hobbyists from CalTech founded Aerojet in Pasadena, Calif. Their breakthrough: so-called jet-assisted takeoff rockets, fueled by solid perchlorate compounds that were highly charged but stable enough to be handled safely aboard ships.

Perchlorate, dubbed "powdered oxygen," is combusted inside a rocket engine with aluminum powder and a rubber-like polymer to stoke an intense burn. To propel a rocket, the solid fuel must be ground and molded into a particular shape. Over time, the fuel breaks down, requiring continual replacements. That's why, for more than 40 years, tons of perchlorate were routinely flushed from rockets and missiles onto the ground and into water supplies.

Aerojet began manufacturing at a plant in the San Gabriel Valley town of Azusa, Calif., about 40 miles east of downtown Los Angeles. Nearly from the start, it had discharge problems. In 1949, the Los Angeles County engineer warned the company in a letter that dumping its hazardous waste into "cesspools" and "seepage beds" posed an "extreme hazard" to the underground water supply. "I cannot too strongly emphasize the necessity of obtaining a sewer connection in the shortest possible time," pleaded the county engineer, who noted Aerojet was already in violation of local discharge restrictions. Aerojet was never punished, and its Azusa plant was connected to an industrial sewer line in 1952.

Move Out of the City

Hemmed in by the burgeoning Los Angeles suburbs, Aerojet moved most of its rocket operations north to some abandoned gold-dredging fields in Rancho Cordova, about 15 miles east of Sacramento. In 1951, shortly after buying the site, an Aerojet employee calculated that about 1,000 gallons of liquid waste, plus 300 pounds of ammonium perchlorate, would flow into the underground aquifer every day. Most of the waste would have "a deleterious effect on both plant life and the underground water supply," he warned in an internal memo. But ammonium perchlorate might "be beneficial in a sewage stream and possibly be slightly beneficial on plant life," he added.

2.

As in the San Gabriel Valley, Aerojet designed a system in Rancho Cordova to channel waste into unlined leaching ponds, apparently assuming whatever pollutants did reach groundwater would

John Decker/FilmMagic

Greg and Doris Voetsch *(left) believe perchlorate made their family sick. Sandra Lester (bottom left) got thyroid disease at 15. Larry Ladd (bottom), with daughter Melody, pressed California and Aerojet to test for perchlorate in local drinking wells.*

be diluted to safe levels. But when those designs were circulated for comment to California's water, health, and fish-and-game departments in Sacramento, the regulators unanimously panned the proposed "percolation beds" as posing grave pollution risks to streams and underground aquifers, state documents show.

Officials sought specific toxicity advice on perchlorate from a botany professor at the University of California at Davis. He replied that perchlorate was "known to be toxic to plant life" and was unlikely to break down "in course of percolation through gravel." For treatment, he recommended evaporation in "sealed beds" and "absorption and contact with organic matter."

Today, this so-called biological method is a common way of extracting perchlorate from water. "It's astonishing how right he was," says Mr. Mayer of the EPA.

On May 15, 1952, California's Central Valley Regional Water Pollution Control Board, over Aerojet's objections, issued Resolution No. 127, barring "entry" of perchlorate and eight other chemicals into local groundwater and the nearby American River. That same year, medical researchers published their findings that perchlorate blocks the uptake of essential iodide into the thyroid gland, thus inhibiting thyroid-hormone production.

Neither the medical findings nor the water board's order had much effect. By

1955, regulators were finding perchlorate in local groundwater. Though hampered by primitive test methods and Navy secrecy, a state hydraulic engineer reported that untreated discharges of some 310 pounds a day of perchlorate were being dumped into "abandoned gold dredger pits." The good news, he reported, was that the waste was seeping into the ground more slowly than expected. The bad news, reported a few months later, was that a nondrinking well on Aerojet's property was contaminated with 1,000 ppb of perchlorate, indicating "waste water from the sump is commingling with underlying groundwater."

Mr. Phillips, the GenCorp general counsel, says Aerojet's disposal practices met all safety and regulatory requirements of the day. "You were supposed to put [perchlorate] in these pits," he says. "We thought the pits were impermeable."

In 1957, a national task group on underground waste reported perchlorate contamination had spread over "several square miles" east of Sacramento. The group's report, published in the American Water Works Association Journal, described perchlorate as a "weedicide" toxic to plants at 1,000 to 2,000 ppb. It said the perchlorate plume near Sacramento ranged from 3.5 million to five million ppb. Also that year, some Harvard University researchers, using studies on guinea pigs, found that perchlorate, after passing through the placenta from the mother, depleted thyroid-hormone production in fetuses.

In 1958, the Water Pollution Control Board notified Aerojet that its discharges were "consistently in violation of the board's requirements." At a special briefing for state agencies in 1960, board engineers described Aerojet's operations as a mess, with "four or five major discharges" into a creek feeding the American River and many smaller releases onto the ground. Aerojet, citing security, wouldn't tell regulators all the chemicals it was using, according to regulators' documents from the briefing.

"We pointed out that just because we do not know what is going on in this area, an area of extremely permeable sediments, the board should not give industry a blank check to discharge anything [it] desired to the groundwater basin," a state engineer wrote after the briefing.

The upshot was Resolution 62-21, the board's 1962 order to Aerojet not to discharge anything "deleterious to human, animal, plant, or aquatic life" into local waters. The resolution set maximum discharge levels for 21 chemicals—1,000 ppb for perchlorate—and ordered Aerojet, for the first time, to "disinfect" all waste before it left Aerojet's property.

But this was the year of the Cuban missile crisis, and Aerojet had other concerns. A unit of General Tire at the time, Aerojet was playing a big part in helping the U.S. close the missile gap with the Soviet Union. At the height of the rocket race in the early 1960s, Aerojet's Sacramento County facility employed 22,000 workers in three shifts, seven days a week. In 1962, they helped build and deploy the first solid-fuel intercontinental ballistic missile, the Minuteman I. Because it didn't require hours to load, as liquid-fuel rockets do, the Minuteman is believed to have helped steel President Kennedy's nerve during the Cuban missile crisis.

Aerojet's operations were overseen by 300 to 400 full-time Pentagon inspectors who approved every facet of design, production and waste disposal, says Aerojet's Mr. Phillips. "Had we known we could have done something to keep this [perchlorate contamination] from happening, they would have given it to us," he says. "Everybody involved thought they were doing the right thing."

Burning the Stuff

In 1961, Aerojet had begun burning its excess perchlorate, along with drums of the chlorinated solvent trichloroethylene, or TCE, which is now considered carcinogenic. Still, large quantities of the chemicals continued to go into the ground, according to accounts by former Aerojet employees given to California investigators in a 1979 criminal probe. (That state investigation was dropped in the mid-1980s, when Aerojet agreed to sign a consent decree to clean up its waste.)

In write-ups of those witness accounts obtained by the Journal, several employees described a chemical "sludge" left over after burning that Aerojet would let seep into the ground or would bury in separate pits. Former employees, including one identified as the foreman of Aerojet's chemical-waste-disposal unit from 1963 to 1968, said they dumped hazardous chemicals into a septic lagoon meant for human waste. Witnesses also said many workers continued dumping perchlorate and TCE into "rock piles" and open ponds. (TCE was heavily used to clean missile parts laden with solid rocket fuel.)

Meanwhile, tests of the underground aquifer at the Aerojet site showed steadily rising concentrations of perchlorate—from 18,000 ppb in the mid-1950s to 91,000 ppb in 1979. In the decade after 1955 alone, Aerojet processed roughly 19 million pounds of ammonium perchlorate at "grind station" Line 03, company documents say. The "daily washdown" of the area flowed into unlined ponds.

The water board issued more discharge orders, with little effect. In February 1976, for example, the board granted permission to Aerojet's Cordova Chemical unit to dig an injection well for inserting waste deep underground. The board's order explicitly barred "pollution" and discharging waste to any "surface drainage courses." Yet just three months after that order came out, Cordova built the 3,500-foot pipeline to channel waste straight into an unlined dredger pit.

"That's the worst thing I know about on this whole place," says Aerojet's Mr. Phillips. The general counsel says that Aerojet never hid its perchlorate contamination. He points out that the company notified the water board in the mid-1970s that it detected perchlorate in its groundwater at 50 times the board's allowable limit. No one worried about it then, Mr. Phillips says, because, among other reasons, Aerojet's wells weren't for drinking.

Perchlorate became a drinking-water concern in 1985, when the EPA detected it in wells serving about 42,000 households near Aerojet's original facility in the San Gabriel Valley, near Los Angeles. The agency found concentrations ranging from 110 ppb to 2,600 ppb. But five of the six so-called field blanks—samples of purified water that were also tested to assure data quality—inexplicably tested positive for perchlorate. Flummoxed, EPA reviewers threw out most of the test results as unreliable. (Today, some EPA officials believe those field blanks probably came from Colorado River water or other tainted sources.)

EPA scientists asked the federal Centers for Disease Control in Atlanta for guidance on possible health risks from perchlorate. The response, written by the Agency for Toxic Substances and Disease Registry on Jan. 26, 1986, underscored the same toxicity concerns the Pentagon and EPA are still arguing about 17 years later. The agency "strongly recommended" retesting the San Gabriel wells.

"Although the limited data available does not suggest that several [thousand ppb] of perchlorates would represent an acute threat to public health," the toxic-substance agency letter concluded, "the effects of continued low-level perchlorate ingestion need to be described as soon as possible."

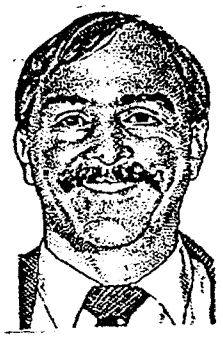
Superfund Sites

Those effects remained undescribed for more than a decade afterward. In 1992, the EPA, citing the 1952 study on perchlorate's effects on thyroid-hormone production, issued its first health assessment of the chemical, proposing an initial reference dose for perchlorate of four ppb in drinking water. By then, Aerojet's facilities in Northern and Southern California had both been named EPA Superfund sites because of contamination by TCE and other known carcinogens. The Sacramento facility, in fact, was treating groundwater for other toxic agents and reinjecting it into the aquifer with 8,000 ppb of perchlorate still in it—with regulators' full assent.

"We did not have any data which indicated that perchlorate had been identified as a contaminant of concern," testified Thomas Pinkos, who oversaw Aerojet's cleanup for the regional water board from 1979 through 1988, in a recent deposition.

After the EPA's 1992 health warning, state officials watched warily as Aerojet's perchlorate plume spread toward drinking wells in Rancho Cordova. At the time, the most-sensitive test equipment could detect perchlorate at levels only above 400 ppb. The defense industry,

meanwhile, was fighting the EPA's health assessment, arguing in a 1995 report to the EPA that the reference dose should be 42,000 ppb in drinking water. Aerojet itself grew less cooperative with state officials, regulators say. "Plumes tended to stop at their fences," one quips.



Kevin Mayer

The logjam broke in early 1997, when a California state lab, prodded by residents in Rancho Cordova, developed a new method for measuring perchlorate down to four ppb. With the lower detection limit, the substance quickly turned up in Rancho Cordova's wells at levels reaching 300 ppb.

The Voetsches learned in the media about the thyroid-disrupting contaminant shuttering nearby wells. Mr. Voetsch says he attended several community meetings, following up with various public and private officials to pursue his family's case. But the only person who returned his calls, he says, was a local geographer and Navy vet named Larry Ladd, who has made perchlorate pollution his passion. The Voetsches then joined the class-action lawsuit, led by the law firm that employs Erin Brockovich, the toxic-tort paralegal played by Julia Roberts in the film of the same name. The suit, among several filed over perchlorate contamination, is mired in the courts, and Mr. Voetsch says he hasn't heard from the lawyers in years.

"I'm thoroughly convinced no one wants to know what's going on here," Mr. Voetsch says.

The firm's chief attorney, Edward Masry, says the perchlorate clients haven't been contacted in several years because a judge put a stay on their case, pending legal motions, but should be hearing from the firm shortly.

With more-sensitive tests, perchlorate quickly turned up in several water supplies in Southern California. In 1997, the San Gabriel Valley plume—11 years after its initial discovery—had spread to a five-square-mile area beneath about 250,000 residents, according to the San Gabriel Basin Water Master.

In nearby San Bernardino County, perchlorate plumes prompted closure of dozens of wells, threatening some communities with water shortages. When local Defense Department officials got wind of a plume in Redlands, Calif., they circulated an internal "bellringer" report telling colleagues to keep the information secret. The June 1997 report noted 250,000 residents could be "adversely affected," with "pregnant women and children" among the most at risk. Yet, citing the local outrage at perchlorate's discovery in wells near Sacramento several months earlier, the report warned of "far reaching ramifications when the public learns of the situation." Its conclusion: "Future procurement programs could be adversely affected due to increased environmental costs."

Plumes Spread

In 1997, the Pentagon and several defense contractors, under EPA pressure, launched the first toxicological studies to determine perchlorate's effects at low exposure levels—the same studies that ultimately led to the EPA's reference dose this year. Meanwhile, perchlorate plumes popped up at defense sites all across the country—Texas and Utah in 1998, then Kansas, Missouri, Nebraska, Iowa, West Virginia and Maryland the next year.

When the Metropolitan Water District of Southern California found the chemical in taps in Los Angeles, scientists traced the plume 400 miles up the Colorado River to Lake Mead, above Hoover Dam. From there, they tracked the plume 10 miles westward, up a desert riverbed called the Las Vegas Wash, to Kerr-McGee Corp.'s giant ammonium perchlorate plant in Henderson, Nev.

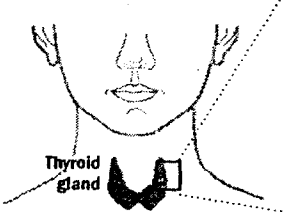
The Navy built the plant in the 1940s to make perchlorate compounds for the war. Inherited by Kerr-McGee in a 1967 merger, the facility spilled thousands of pounds of perchlorate waste every day through the mid-1970s into unlined evaporation ponds. The chemical leached into shallow groundwater over the years, seeping into the Las Vegas Wash, the main drain into Lake Mead for wastewater coming from Las Vegas.

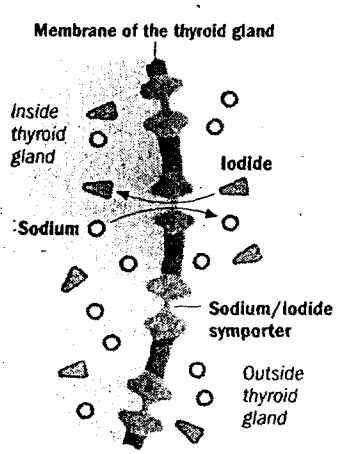
Perchlorate was detected in Kerr-McGee's groundwater back in the mid-1980s, and it was ignored. The company was then treating the aquifer for the metal chromium-6, and reinjecting high levels of perchlorate-tainted water back underground, say officials of Nevada's Division of Environmental Protection. "The guidance on perchlorate was lacking," says Patrick Corbett, director of environmental affairs for Kerr-McGee, based in Oklahoma City.

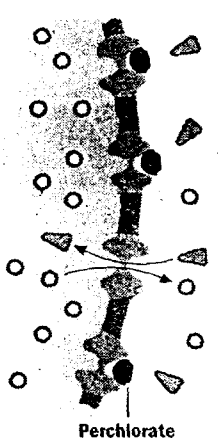
Kerr-McGee is spending roughly $70 million to extract perchlorate, too, but is catching only about half the 900 pounds a day seeping into the Las Vegas Wash, EPA officials say. The company, which has filed a lawsuit seeking Pentagon reimbursement for the cleanup costs, says it's adding new systems to capture much more of the perchlorate. Still, so much perchlorate has already entered Lake Mead that the levels below Hoover Dam—all the way out to Los Ange-

Blocking Agent

In the human body, perchlorate inhibits production of thyroid hormones, essential to normal organ development in babies, especially brain development.







1 Iodide from foods, such as salt, enters the body.

2 Iodide is transported into the thyroid by the sodium/iodide symporter (NIS) as sodium is transported out. The iodide is then used to produce thyroid hormones.

3 If perchlorate is ingested, it blocks the symporter, disrupting the uptake of iodide.

Sources: Environmental Protection Agency; Environmental Working Group

les—have hardly budged in five years, ranging from five to 10 ppb.

'Decades of Dilution'

"It will probably take decades for the dilution effect to flush it all out," says Douglas Zimmerman, an environmental regulator in Nevada.

In addition to slaking thirsts across the Southwest, the Colorado River water irrigates 95% of America's winter lettuce crop, grown in Yuma, Ariz., and California's Imperial Valley. The EPA says it still doesn't know if lettuce and other vegetables accumulate perchlorate from irrigation water, but preliminary indications aren't good. Tests on several vegetable samples from a perchlorate-contaminated farm in Redlands found the plants concentrated perchlorate from local irrigation water by an average factor of 65, according to calculations by Renee Sharp of the Environmental Working Group in Oakland, Calif., one of the few nonprofit groups focused on perchlorate contamination. That means the perchlorate dose in the vegetables was 65 times the amount in the water.

"If people are eating it, on top of drinking it, the EPA will have to lower its proposed drinking-water standard substantially," Ms. Sharp says.

For now, that standard is only a recommendation. Enactment of a national standard will have to wait until either the EPA or the defense establishment prevails. Meanwhile, Aerojet and Lockheed Martin Corp. are already spending hundreds of millions of dollars to extract perchlorate from aquifers they polluted in California, with much of it being reimbursed by the Pentagon.

Sandra Lester thinks it's too little, too late to help her. She grew up on Rancho Cordova's perchlorate plume, near the Voetsch family, and fell sick with Graves' disease at age 15. Now 20, she wants to become a large-animal veterinarian, but is still enfeebled by skin problems, muscle pains and other complications of her disease. She blames perchlorate and had joined another class-action suit, but she heard this month that the law firm is dropping her case.

"It doesn't seem like the government cares very much about this problem," she says. "It's not like perchlorate is killing people. It's slow."

* * * * *

The Debate Over Safety Levels

Perchlorate is one of a newly recognized group of toxins called endocrine disrupters—chemicals such as dioxin and PCBs that can alter hormonal balances and thus impede human reproduction and development.

The debate is over how much perchlorate causes harm, and whether fetuses and infants are more susceptible than adults to perchlorate's effects at very low doses.

The EPA, citing experiments on rats and epidemiological studies in Arizona and California, says perchlorate is dangerous in drinking water at levels above one part per billion. The Pentagon and defense industry, citing human experiments and epidemiological studies in Chile, say perchlorate is safe in drinking water below 200 ppb. Billions of dollars in cleanup and liability costs may hang in the balance, since most perchlorate plumes in the U.S., including the Colorado River, range between four and 100 ppb.

In 1993, several defense contractors, backed by the Pentagon, created the Perchlorate Study Group to research toxicity. The group's "goal," according to an internal document written in 1996 by GenCorp's Aerojet subsidiary, was "to provide EPA with a scientific-based argument to justify a higher [reference dose] and thus a more reasonable remediation standard." The industry group has spent roughly $7 million on toxicity studies.

Yet, as with other contentious toxins such as arsenic and lead, the more information EPA scientists learned about perchlorate, the more they worried about its effects. Their main concern focuses on changes found in the brain size of laboratory rat pups exposed to low doses of perchlorate in utero. Such changes in so-called brain morphometry indicate perchlorate's thyroid effects may cause permanent neurological damage—in rats as well as people, the EPA says, because the thyroid system works similarly in both species.

The Pentagon and its allies say the rat studies, which the industry's study group directed and sponsored, used poor autopsy techniques on the rats. And why trust rat data, they argue, when human data are available? The Pentagon and its allies cite an Oregon study that found small doses of perchlorate, given orally to adult volunteers, had little effect on thyroid-hormone levels.

The EPA says the human study didn't examine the most-sensitive subgroups—pregnant mothers and infants—and was much too brief to measure the effects of long-term exposure.

To counter, the defense establishment cites an epidemiological study of three Chilean villages with varying levels of naturally occurring perchlorate in their drinking water. The study's conclusion: Perchlorate had little effect on the thyroid-hormone levels of newborns and children in the three villages studied.

The EPA prefers a different epidemiological study that it claims shows "strong evidence" of perchlorate's danger to infants. That study found California babies born to mothers exposed to trace amounts of perchlorate in drinking water had lower thyroid-hormone levels at birth than did infants of nonexposed moms. California's Office of Environmental Health Hazard Assessment recently used that study, and other human data, to derive its own "health goal" for perchlorate in drinking water of two ppb.

—Peter Waldman